AMENDMENTS TO THE CLAIMS

1. (currently amended) A method of automatically calibrating a wafer-handling robot, the method comprising:

determining an orientation of a robot relative to a chassis of a wafer processing system;

determining hand-off coordinates of a load port in the wafer processing system; and

determining hand-off coordinates of a first load lock in the wafer processing system[[.]];

wherein determining the orientation of the robot relative to the chassis of the wafer processing system comprises:

using the robot to find a first sensor located on one end of the wafer processing system;

using the robot to find a second sensor located on another end of the wafer processing system;

determining a distance between the first sensor and the second sensor; and

determining an offset between a coordinate frame of the robot and a coordinate frame of the wafer processing system.

2. (original) The method of claim 1 further comprising:
performing wafer mapping calibration using a load port fixture; and
performing a wafer centering calibration routine.

3. (canceled)

4. (currently amended) The method of claim [[3]] 1 further comprising:
comparing the distance to an expected value or a range of values.

5. (original) The method of claim 1 wherein determining the hand-off coordinates of the load port comprises:

adjusting theta coordinates of locations in a load port fixture based on the orientation of the robot relative to the chassis of the wafer processing system;

moving an end-effector of the robot to a first wafer slot of the load port fixture;

moving the end-effector to a second wafer slot of the load port fixture; and

determining a leveling difference between z-axes of the robot and the load port.

6. (original) The method of claim 1 wherein determining the hand-off coordinates of the first load lock in the wafer processing system comprises:

determining a safe z-coordinate for entering the first load lock;

determining a wafer transfer plane; and

determining radial and theta coordinates for wafer hand-off.

7. (original) The method of claim 6 wherein determining the safe z-coordinate for entering the first load lock comprises:

using the robot to find a feature located outside the first load lock.

8. (original) The method of claim 1 wherein the wafer processing system comprises a chemical vapor deposition system.

9. (currently amended) A calibration fixture for automatically calibrating a load port in a wafer processing system, the calibration fixture comprising:

a plurality of wafer slots;

a first sensor having a beam configured along an axis that represents a wafer center; and

a calibration disk[[.]], wherein the calibration disk includes a surface simulating an edge of a wafer.

10. (original) The calibration fixture of claim 9 wherein the calibration disk includes a central hole through which the beam of the first sensor passes through.

11. (canceled)

12. (original) The calibration fixture of claim 9 further comprising a flag for providing a z-axis reference.

13. (original) The calibration fixture of claim 12 wherein the flag comprises a metallic disk.

14. (original) The calibration fixture of claim 9 wherein the calibration fixture simulates a front-opening unified pod (FOUP).

15. (original) The calibration fixture of claim 9 further comprising an interface port for allowing a sensor signal from the calibration fixture to be coupled to a computer.

16. (original) A method of automatically calibrating a wafer-handling robot to a loading port of a wafer processing system, the method comprising:

providing a calibration fixture;

determining radial and theta locations in the calibration fixture;

determining a z-reference in the calibration fixture;

moving an end-effector of a robot to a first wafer slot in the calibration fixture;

moving the end-effector to a second wafer slot in the calibration fixture; and

determining a leveling difference between z-axes of the robot and the calibration fixture.

17. (original) The method of claim 16 wherein determining the radial and theta locations in the calibration fixture comprises:

finding a sensor beam passing along an axis that represents a wafer center in the calibration fixture.

18. (original) The method of claim 16 wherein the calibration fixture simulates a front-opening unified pod (FOUP).

19. (original) The method of claim 16 wherein determining the z-reference in the calibration fixture comprises:
determining an initial z-reference; and
determining a refined z-reference.

20. (currently amended) The method of claim 19 wherein determining ~~an~~ the initial z-reference comprises finding a calibration disk mounted in the calibration fixture, and wherein determining the refined z-reference comprises refining the initial z-reference by finding a flag in the calibration fixture.

21. (new) A method of automatically calibrating a wafer-handling robot, the method comprising:
determining an orientation of a robot relative to a chassis of a wafer processing system;
determining hand-off coordinates of a load port in the wafer processing system; and
determining hand-off coordinates of a first load lock in the wafer processing system;
wherein determining the hand-off coordinates of the load port comprises:
adjusting theta coordinates of locations in a load port fixture based on the orientation of the robot relative to the chassis of the wafer processing system;
moving an end-effector of the robot to a first wafer slot of the load port fixture;
moving the end-effector to a second wafer slot of the load port fixture; and
determining a leveling difference between z-axes of the robot and the load port.

22. (new) The method of claim 21 further comprising:
performing wafer mapping calibration using the load port fixture; and
performing a wafer centering calibration routine.

23. (new) The method of claim 21 wherein determining the orientation of the robot relative to the chassis of the wafer processing system comprises:
using the robot to find a first sensor located on one end of the wafer processing system;
using the robot to find a second sensor located on another end of the wafer processing system;
determining a distance between the first sensor and the second sensor; and
determining an offset between a coordinate frame of the robot and a coordinate frame of the wafer processing system.

24. (new) The method of claim 23 further comprising:
comparing the distance to an expected value or a range of values.

25. (new) The method of claim 21 wherein determining the hand-off coordinates of the first load lock in the wafer processing system comprises:

determining a safe z-coordinate for entering the first load lock;

determining a wafer transfer plane; and

determining radial and theta coordinates for wafer hand-off.

26. (new) The method of claim 25 wherein determining the safe z-coordinate for entering the first load lock comprises:

using the robot to find a feature located outside the first load lock.

27. (new) The method of claim 21 wherein the wafer processing system comprises a chemical vapor deposition system.

28. (new) A calibration fixture for automatically calibrating a load port in a wafer processing system, the calibration fixture comprising:

a plurality of wafer slots;

a first sensor having a beam configured along an axis that represents a wafer center;

a calibration disk;

a flag for providing a z-axis reference, wherein the flag comprises a metallic disc.

29. (new) The calibration fixture of claim 28 wherein the calibration disk includes a central hole through which the beam of the first sensor passes through.

30. (new) The calibration fixture of claim 28 wherein the calibration fixture simulates a front-opening unified pod (FOUP).

31. (new) The calibration fixture of claim 28 further comprising an interface port for allowing a sensor signal from the calibration fixture to be coupled to a computer.